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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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09/437,135 11/10/99 YAMAZAKI

S 0756-2064 *afw*

MM71/0917
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EXAMINER

KIELIN, E

ART UNIT

PAPER NUMBER

2813

DATE MAILED: 09/17/01

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trad marks

Office Action Summary

Application No.

09/437,135

Applicant(s)

Yamazaki et al.

Examiner

Erik Kielin

Art Unit

2813



— The MAILING DATE of this communication appears on the cover sheet with the correspondence address —

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on Aug 20, 2001.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-14 and 29-37 is/are pending in the application.
- 4a) Of the above, claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-14 and 29-37 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are objected to by the Examiner.
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

- 13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).
- a) ☐ All b) ☐ Some* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- *See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

- 15) ☐ Notice of References Cited (PTO-892)
- 16) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 17) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s): 8, 13, 1
- 18) ☐ Interview Summary (PTO-413) Paper No(s): _____
- 19) ☐ Notice of Informal Patent Application (PTO-152)
- 20) ☐ Other:

Art Unit: 2813

DETAILED ACTION

Information Disclosure Statement

1. The information disclosure statement filed 11/10/99, 2/16/00 fails to comply with 37 CFR 1.98(a)(2), which requires a legible copy of each U.S. and foreign patent; each publication or that portion which caused it to be listed; and all other information or that portion which caused it to be listed. It has been placed in the application file, but the information referred to therein has not been considered.

Examiner notes, in reply to the request in Paper No. 12, filed 4/19/01, that Examiner consider the references of the IDS of 11/10/99. The vast majority of the approximately 130 references were neither provided nor present in the parent application.

The following is a list of the references that **could be found** in the parent application, 08/721,526, filed 26 September 1996: the US patents 5237188, 5077233, 4851370, 5476802, 5608232, 5689698, 5700333; the abstracts of the Japanese patents 1-149475, 1-128572, 61-89621, 61-166074, 5-55246; the European patent 0 178 447; and the article by C. Hayzelden, et al. No other references were available in the parent. The abandoned application, 08/111,522 is unavailable. If any IDS references were in that abandoned application, they are unavailable to Examiner. Applicant is requested to provide copies of all references on the IDS.

Art Unit: 2813

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1-4, 6-9, 30-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's admitted prior art (APA) in view of either **Ang et al.** ("Electrical characterization of low-pressure chemical-vapor-deposited silicon dioxide metal-oxide-silicon structures" Journal of Applied Physics 73(5), pp. 2397-2401, 1 March 1993).

Applicant's **APA** discloses that it is known in the art to make a TFT by forming a semiconductor film comprising amorphous silicon over a substrate; crystallizing said semiconductor film by irradiating a laser light; forming an insulating film on the crystallized semiconductor film by vapor phase deposition (Applicant's specification, pages 2-4).

Applicant **APA** does not teach annealing the insulating layer in an atmosphere comprising an oxygen gas.

Ang teaches the benefits of depositing an insulating layer for a gate oxide using LPCVD and then thermally annealing in oxygen using a Heatpulse 210T rapid thermal processor which emits high intensity IR light (see attached document, page 1, from UC-Berkeley obtained by the Internet for verification) in order to reduce the interfacial layer density (called both "fixed charge

Art Unit: 2813

density” and “interface state density” therein) to well below 10^{11} cm^{-2} . (See Abstract and section entitled “Experiment.”)

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Applicant’s **APA** with **Ang** for the numerous benefits taught by **Angstroms**.

Although the exact pressure range of 10Torr or less is not taught, it would be a matter of routine optimization to find the optimum oxygen pressure range based upon the teaching of Ang in order to optimize the reduction of surface state traps. These claims are *prima facie* obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. In re Woodruff, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also In re Huang, 40 USPQ2d 1685, 1688(Fed. Cir. 1996)(claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also In re Aller, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art general conditions is obvious).

In this regard, Applicant’s specification states that the pressure during the anneal may be 10 Torr or less **or may be atmospheric pressure** (page 15, lines 11-13), so it is completely unclear based upon Applicant’s own admission, as to how the pressure could be critical in achieving the object of the annealing step of the CVD oxide layer when clearly a multiplicity of pressures has been indicated as capable of achieving the objective. This only serves to indicate the

Art Unit: 2813

one of ordinary skill would know to find a pressure that provided the optimum results for the desired application of the gate oxide layer.

4. Claims 1-4, 6-9, 11-13, 29, 30-33, and 34-37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's **APA** in view of **Roy** (US 5,153,701) and **Wolf** (Silicon Processing for the VLSI Era, Vol. 1, Lattice Press: Sunset Beach, CA, 1986, pp. 57-58) or alternatively in view of **Roy** and **JP 58-098933**.

Applicant's **APA** is applied as above.

Roy teaches the benefits of using LPCVD or PECVD and TEOS to form an insulating film comprising SiO₂ on a semiconductor film for use as a gate electrode and then annealing in oxygen for the express purpose of reducing interfacial layer density (called "charge traps" or "interface trap density" therein). (See column 2, lines 16-21; column 3, lines 23-44; column 7, line 41).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Applicant's **APA** in view of **Roy** for the reasons indicated in **Roy** or specifically annealing in oxygen to reduce interfacial layer density.

Although the exact pressure range of 10Torr or less is not taught, it would be a matter of routine optimization to find the optimum oxygen pressure range based upon the teaching of **Ang** in order to optimize the reduction of surface state traps. These claims are *prima facie* obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range.

Art Unit: 2813

In re Woodruff, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also In re Huang, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996) (claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also In re Aller, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art general conditions is obvious).

In this regard, Applicant's specification states that the pressure during the anneal may be 10 Torr or less **or may be atmospheric pressure** (page 15, lines 11-13), so it is completely unclear based upon Applicant's own admission, as to how the pressure could be critical in achieving the object of the annealing step of the CVD oxide layer when clearly a multiplicity of pressures has been indicated as capable of achieving the objective. This only serves to indicate the one of ordinary skill would know to find a pressure that provided the optimum results for the desired application of the gate oxide layer.

Then the only difference is that high intensity IR annealing is not taught.

Wolf teaches the benefits of rapid thermal annealing using high intensity IR. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the high intensity IR annealing method of **Wolf** for the **Roy** annealing source of heat for the reasons in **Wolf**.

Alternatively, **JP 58-098933** teaches the benefits of using CVD to deposit an insulating film comprising SiO₂ on a silicon substrate, followed by UV, IR or laser annealing to expressly

Art Unit: 2813

reduce the interfacial layer density (called "boundary level density" therein). (See Abstract and Derwent Abstract.)

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use IR as the annealing method for the reasons in **JP 58-098933**, which include specifically to reduce the interfacial state density at the Si/SiO₂ interface of CVD deposited SiO₂.

5. Claims 5, 10, 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's **APA** in view of **Ang** or alternatively over Applicant's **APA** in view of **Roy and Wolf** or alternatively over Applicant's **APA** in view of **Roy and JP 58-098933**, any of the above as applied to claims 1-4, 6-9 above, and further in view of **JP 60-187030**.

Applicant's **APA** does not indicate the kind of laser to be used for crystallizing the silicon film. But **JP 60187030** discloses the benefits of Applicant's claimed laser for such crystallizing (Abstract). It would have been obvious to one of ordinary skill in the art at the time the invention was made to crystallize the silicon using the lasers in **JP 60187030** for the reasons indicated therein.

Response to Arguments

6. Applicant's arguments filed 8/20/01 have been fully considered but they are not persuasive. Applicant's Representative argues, regarding the use of the added limitation to the claims

Art Unit: 2813

of irradiating the silicon oxide layer “under a pressure of 10 Torr or less,” (1) “there is a lack of motivation in the respective teaching of the proposed modifications...” (2) “is unobviously advantageous since it reduces the number of trap centers caused by hydrocarbon in the insulating film” and (3) the combination of applied references “would not yield the benefits presently set forth in the claimed invention.”

Examiner disagrees. Applicant’s specification states that the pressure during the anneal may be 10 Torr or less or may be atmospheric pressure (page 15, lines 11-13), so it is completely unclear based upon Applicant’s own admission, as to how the pressure could be critical in achieving the object of the annealing step of the CVD oxide layer when clearly a multiplicity of pressures has been indicated as capable of achieving the objective.

Conclusion

7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37

Art Unit: 2813

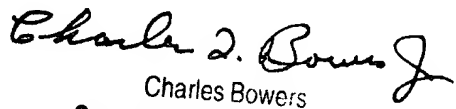
CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication from examiner should be directed to Erik Kielin whose telephone number is (703) 306-5980 and e-mail address is erik.kielin@uspto.gov. The examiner can normally be reached by telephone on Monday through Thursday 9:00 AM until 7:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Charles Bowers, can be reached at (703) 308-2417 or by e-mail at charles.bowers@uspto.gov. The fax phone number for the group is (703) 308-7722 or -7724.


EK

September 12, 2001


Charles Bowers
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